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Research in Palo Alto, California, is attempting to discover distinguishing characteristics of educationally handicapped children (EH) and to clarify the causes of their learning disabilities. 76 EH children and their 76 same sex siblings (EH sibs) were matched with 76 academically successful students (SA) and their same siblings (SA sibs). Matching was done on the basis of grade, sex, and intelligence for EH and SA; of grade and sex for the siblings. No significant differences were found between the experimental and control group in distribution of older and younger siblings, ordinal position in the family, socio-economic status, or fathers' occupations. Parental interviews, reading tests and academic histories of parents; psychological, educational, medical, and neurological evaluations of the children, and behavior ratings of the children were used. Examiners were unaware of the classification of the child as EH or SA. Preliminary findings include: (1) significant differences in favor of EH on the Performance Scale of the Wechsler Intelligence Scale for Children, (2) impaired ability of EH and EH sibs in numerical computation, sequencing, and fine-perceptual-motor-hand-eye coordination and memory, and (3) lower achievement of EH in reading and spelling. Neurological impairment was significant in several areas for EH, and some medical-history facts were distinguishing. (AE)

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The Palo Alto Study of Educationally Handicapped Children

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Introduction

Preliminary reports of the Palo Alto research on Educationally Handicapped pupils were presented at the Society for Research in Child Development Meetings in New York City in 1967 (Owen, 1968). The purpose of this introductory paper is to briefly review the earlier papers; including the major goals of the research, the sample, the data collecting procedures and the significant intellectual, medical and perceptual-motor findings.

The study is being made in the Palo Alto Unified School District here in California where there is a special remedial program for "educationally-handicapped" pupils (hereafter referred to as EH) (Owen, 1968). The major criteria for identification as EH is a significant discrepancy between ability and school achievement (1.5 to 2 years retarded). Approximately 2% (or 300 out of 16,000) are selected for this remedial help; hence, the children represent a rather severely impaired group academically (Money, 1966).

Purpose of the Study: Our research has two major purposes:

1) To discover whether the characteristics of these academically handicapped children can be more precisely identified and described;
2) To further clarify the causes of learning disabilities.

The design consists first in comparing EH children, a) with their same sex siblings, and b) with matched same sex children who are academically successful, and their siblings. Second, in comparing the parents of the EH children with the parents of the Successful Academic children on a number of items. This design makes it possible to explore the familial aspects of the abnormality.

Subjects

The subjects are 304 elementary and junior high school children; 244 are

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boys and 60 are girls. Table I describes the sample. There are 76 EH children, and their 76 same sex siblings (referred to as EH and EH sibs). The 76 EH children are matched on the basis of grade, sex, and intelligence (within 10 points on the WISC) with 76 children who are successful academically (referred to as SA and SA sibs), and their 76 same sex siblings. The two sets of siblings are matched for grade and sex.

We first screened the remedial population to locate EH students with same sex siblings in our school district. After obtaining written permission from the parents for their children to participate (and with the understanding that the parents, too, would be involved), the EH children were given individual mental tests to see whether they would meet the criterion of normal ability (a full scale IQ of 90 or above).

Once having selected an appropriate EH - EH sib pair, we proceeded to locate a successful academic child with an appropriate sibling to match the EH pair. A clerical assistant combed the school district rosters in order to locate several potential matches. For example, let us suppose that we were searching for a successful academic student in the 6th grade, IQ $\pm$ 10 points from 120, who also had a male sibling in the 3rd grade. After locating 5 or 6 possibilities, we sent out a simple rating form to the appropriate classroom teachers to obtain a teacher estimate of ability and academic performance. Previous test results available from school records were also considered. We then approached the families of children who appeared to be reasonable matches and, once having obtained parent cooperation, we proceeded to test the successful academic child to see whether or not he met our requirements. We tested 184 children in order to locate the 76 matched sets of EH and SA children included in the study. Of the 76 EH subjects, 64 were located from within the population of remedial children; 12 were recommended by school principals and guidance consultants.

The mean age of the experimental and control children is 10 years. The mean age of the sibling groups is 9 years, 8 months. The average age difference between the EH and EH sibs is 2 years, 9 months; between the SA and SA sibs it is 2 years and 10 months. There are no significant differences in the distribution of older and younger siblings between the experimental and control

groups.

The ordinal position within the family is not significantly related to learning disability in the sample.

Data obtained from parent interviews and school records indicate that our experimental and control groups do not differ significantly in social-economic background. Palo Alto is a university and scientific community with a primarily middle to upper-middle class population. Fig. 1 presents the educational levels of the fathers of the two groups. As you can see, these levels are practically identical. Furthermore, there are no significant differences between the groups on the occupational level of the fathers (Hollingshead 1958).

Procedures: The data collecting procedures employed in the study involved both individual interviews and evaluations with the children and their parents. All children in the study were given psychological and educational evaluations. A research assistant contacted the various schools and set up appointments. The psychologists, Dr. Adams and Mrs. Fisher, saw the children without knowing whether they were experimental or control subjects. The tests administered and the order of presentation are as follows: WISC, Bender, Draw-A-Person, and Wide Range Achievement Test. In addition, a brief child interview, and a rating of his behavior during the testing interviews were completed.

The research assistant also set up appointments for Dr. Forrest, the pediatric neurologist, who also examined the children without knowing whether they were experimental or control subjects. He assessed the EH, EH sibs, and the SA children medically and neurologically. Following the medical examinations, Dr. Forrest and one other physician interviewed the children's mothers to obtain family medical histories, and signed releases for the hospital birth records on the children. In 1967-68 EEG studies were made on 25 EH and their siblings; and 25 SA's and their siblings (Total N = 100).

Behavior ratings of the children were obtained in the following manner. A clerical worker was given a coded list of the participating children's names and schools. She was asked to go to the schools and to type information available in the cumulative records related to school adjustment and behavior. (In California there is a particular section of the cumulative record designated for this kind of information.) Code numbers were placed on the back of the cards. Thus, it was possible for three raters to work with these cards with

with no knowledge about the groups to which the children were assigned to the study.

Two psychiatrists and two clinical psychologists (2 men and 2 women) interviewed separately the mothers and fathers of the children. These interviews were recorded on tape and were transcribed. At the end of the interview, we administered reading tests (WRAT) to both the mothers and fathers of the children and obtained releases from them in order to send for their high school records (Robbins, 1963).

Information regarding the speech and language development of the children was available from the Speech and Hearing Department in the Palo Alto Unified School District.* All children entering kindergarten in Palo Alto receive speech and language evaluations from qualified therapists. When difficulties are present, they are diagnosed and appropriate therapeutic measures instituted. These data were available for the EH and their siblings; as well as for the SA's and their siblings.

Review of Preliminary Findings

Intellectual and Achievement Functioning. In 1967 Dr. Pauline Adams reported on the intellectual and achievement functioning of the children (Adams, 1968). As indicated earlier, the EH and SA subjects were matched within 10 points on the basis of their WISC full scale IQ's (Fig. 2). The mean Verbal and Performance Scale IQ scores of all groups except the EH's are within one IQ point of each other, while there is a significant ($p < .01$) IQ difference of 5.73 points in favor of the Performance Scale for the EH children. (The EH children with a positive performance discrepancy of 15 or more IQ points will be discussed in the final paper this morning.)

An analysis of the sub-test scaled scores on the WISC demonstrated impaired ability in numerical computation, sequencing, and fine-perceptual-motor hand-eye coordination and memory. Moreover, the siblings of the EH's showed similar weaknesses.

Achievement test (WRAT) findings indicated that both EH and EH Sibs were significantly ($p < .01$) behind SA and SAS in reading and spelling. Fig. 3 pre-

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*Mrs. Ruth M. Jackson, Coordinator of this program, generously contributed these data for the project.

sents the achievement discrepancy scores for each group.

As described earlier, data were collected related to the children's behavior in school. Figure 4 presents the number of children in each rating category from very poor to excellent. EH versus SA and EHS versus SAS are highly significant ($p<.01$). Sibling similarities are also marked.

As reported, the parents' high school transcripts and adult reading skills were evaluated. As adults, EH fathers when compared with SA were less able readers ($p<.02$). High school English grades significantly differentiate both mothers and fathers in the experimental and control groups. The successful academic children's parents were significantly better ($p<.02$).

Mathematics grades did not differentiate fathers. The EH mothers, however, were significantly poorer than the SA mothers ($p<.05$).

Neurological and Medical Factors. In New York Dr. Thomas Forrest discussed neurological and medical measures that differentiated EH from SA. He also explored areas where strong similarities were apparent between EH and their siblings (Forrest, 1968).

His data indicated that EH compared with SA were impaired in the following areas:

1) The ability to reproduce a tapped pattern $p<.01$
2) Right-left discrimination $p<.01$ (Belmont, 1965), Silver & Hagen, 1960)
3) Double simultaneous touch $p<.05$ (Pollack, 1957)
4) Fast alternating finger movements $p<.05$ (Hertzig & Birch, 1966)
5) Fast alternating hand movements $p<.01$

The following medical-history factors differentiated EH from SA:

1. Irritability during infancy $p<.05$
2. Colic $p<.05$
3. Decreased pre-lingual sound production $p<.05$
4. Poor listening skills after age two $p<.01$
5. Ease of mother-child communication $p<.01$
6. Temper tantrums $p<.05$

Perceptual-Motor Functioning. At the earlier symposium, Mrs. Sara Fisher presented data on the perceptual-motor functioning of the EH and SA children (Fisher, 1968). The two assessment instruments utilized were the Draw-A-Person

(Goodenough, 1926) and the Bender-Gestalt (Bender, 1938); both differentiated significantly between EH and SA as well as between sibling groups. The Koppitz Developmental Norms (Koppitz, 1964) were used to score the Bender-Gestalt (EH versus SA, ($p < .01$); EHS versus SAS, ($p < .01$)).

The drawings (DAP) were evaluated with the Harris Point Scale (Harris, 1963). (EH versus SAS, ($p < .05$)).

Obviously, time does not permit a detailed discussion of these earlier reports, and, as a consequence much useful and fascinating material has, of necessity, been deleted in these comments. At this time, I would like to turn the symposium back to Dr. Stolz so we may begin with today's reports.

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